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BATLS

Battlefield Advanced Training Life Support

Chapter 14
Analgesia

AIM

1401. On successfully completing this topic you will:

- Understand how pain is caused.
- Understand how drugs that treat pain work.
- Have a system for managing the casualty in pain.
- Be able to use a simple scheme for using morphine on the battlefield.

INTRODUCTION

1402. Pain affects people in different ways. Some people seem able to tolerate pain while others cannot. This may be influenced by a person's emotional state (including their expectation of the consequences of injury), by alcohol and by other drugs. A persons culture and their society's expectations of behaviour also influence the way they show their response to pain.

Pathophysiology

1403. Trauma causes tissue damage. Damaged tissue releases chemicals and these stimulate the nerves that sense pain (different types of nerves respond to different stimuli; some respond to pain, other to light touch and temperature). Stimuli pass along nerves to the spinal cord. The spinal cord acts like a junction box deciding which signals continue on upwards to the brain and which do not. In the brain, signals from pain nerves are felt as pain. The process from the point of injury to the brain is called the *pain pathway*.

1404. Nerves can also be damaged directly by trauma. A nerve close to a fracture site may be stretched and damaged by bone movement, causing pain.

1405. Damage to the spinal cord may prevent pain stimuli being transmitted to the brain. The casualty will be unable to feel pain below the level of the spinal damage. Injuries below this level may not be noticed by the casualty (or by the person examining the casualty, a point that can lead to further damage to the injured part).

1406. The casualty distressed by pain produces extra stress chemicals (catecholamines) such as adrenaline. Catecholamines cause tachycardia, peripheral vasoconstriction, poor tissue perfusion and a rise in intracranial pressure. The cumulative effect is to exaggerate the detrimental features of clinical shock.

1407. Hypoxia and hypercarbia also worsen the pain threshold.

Initial assessment and management

1408. *Reassure the casualty*. Explain what is happening now and what is going to happen. Ask yourself, *is the casualty distressed due to hypoxia, shock, pain or all of these*.

1409. Management of **A**irway, **B**reathing and **C**irculation comes first. Correcting hypoxia, hypercarbia and hypovolaemia helps to relieve the pathophysiology of uncontrolled pain.

1410. Simple measures to treat pain should be tried first:

- Splinting fractures. (See paragraphy 1123).
- Cooling burns. (See paragraph 1212).

1411. Use of pain relieving drugs will depend on:

- What drugs are available.
- What other equipment (such as syringes and needles) is available.
- Contraindications to a drugs use such as allergy or pregnancy.
- The clinical condition of the casualty.
- How many casualties there are.
- What monitoring and nursing care can be given to them.
- The skill, experience and training of the person administering the drug.
- The legal entitlement of the medical or nursing personnel to use a particular drug.
- Whether the casualty is about to receive general anaesthesia and surgery.

Drug action

1412. A drug usually causes its effect by working at a site of action. Once a drug has been absorbed into the blood stream, it travels all over the body. At certain places in the body it meets a site of action; this could be a specialised area on the surface of a cell (a receptor). The interaction between the drug and the receptor causes chemical changes inside the cell which, in turn, produce an effect. Pain control is one such effect.

1413. Because the drug travels all over the body it interacts with receptors all over the body. Different receptors product different effects, some wanted and some unwanted. For example, the wanted effect of morphine

is pain control. Unwanted effects include respiratory depression, constipation and constriction in the pupil of the eye.
1414. Different drugs work at different sites along the pain pathway. Morphine influences pain transmission to the spinal cord and perception in the brain. Local anaesthetic drugs temporarily stop transmission of pain impulses in nerves. Non-steroidal anti-inflammatory drugs act on the pain chemicals released at the site of the injury.
1415. Pain control may involve a combination of simple measures and different drugs.

Routes of administration
1416. A drug swallowed as a tablet has to be broken up into very small pieces in the gut before being absorbed across the wall of the gut and into the blood stream. This will depend on the blood supply to the gut and also on gut motility, which moves food and gut contents along within the gut. Motility is important as food or drugs may have to reach particular places within the gut before being absorbed. The whole process – motility and absorption – is delayed by injury and shock.
1417. A drug injected into a muscle (intramuscular) or under the skin (subcutaneous) needs to travel from the muscle or skin by blood flow and then on the site of action.
1418. In shock, where blood supply to skin and muscle is reduced, it takes much longer for the drug to be absorbed and reach the site of action. A return of blood supply to skin and muscle during resuscitation can wash the drug out rapidly into the blood and produce a relative overdose. This needs to be anticipated and watched for during resuscitation.
1419. A drug given directly into a vein (intravenous) is rapidly carried to the site of action and causes its effects. Intravenous drugs are best given in a series of small doses, assessing the casualty's response between each dose.
1420. Drugs can also be inhaled, for example, Entonox (50% oxygen and 50% nitrous oxide). This goes into the lungs, crosses into the blood and is taken to sites all over the body. The proportion that crosses into the brain gives an analgesic effect.
1421. Local anaesthetic drugs (for example, lignocaine) may be used to temporarily block pain impulses in nerves and the spinal cord. The local anaesthetic is injected close to the appropriate nerve. This requires a good knowledge of anatomy.

The ideal analgesic
1422. The ideal analgesic should have:
- A predictable action.
- No side effects.
- A long duration of action.
- A readily available antidote.

And be:
- Easily administered.
- Easily stored and transported.

1423. None of our currently available drugs meet all these criteria. Choice of drug will be influenced by the factors listed in paragraph 1411. The following is a practical guide to using analgesic drugs in the battle casualty.

MINOR INJURY

Musculo-skeletal pain, for example, sprains, fractures and minor fragment injury
1424. Consider paracetamol and Non Steroidal Anti-Inflammatory Drugs (NSAIDs). Use doses and routes as given in CTRs. A range of NSAIDs are available but differ in terms of recommended dosage, dosage interval, licensed route of administration and severity of side effects. Some have been associated with an increase in pre operative bleeding during surgery and with post operative wound haemorrhage.

> The surgical team need to know the casualty has received NSAIDS.

1425. NSAIDs can cause acute renal failure, particularly in casualties with diminished renal perfusion.

> This means that they should not be used in cases of major injury associated with haemorrhage and shock.

1426. NSAIDs can also exacerbate asthma, cause gastric irritation and should not be used in aspirin sensitive casualties.
1427. Other drug options include: codeine phosphate and combinations of paracetamol with codeine, dihydrocodeine or dextropropoxyphene (See CTRs).

MODERATE TO SEVERE INJURY

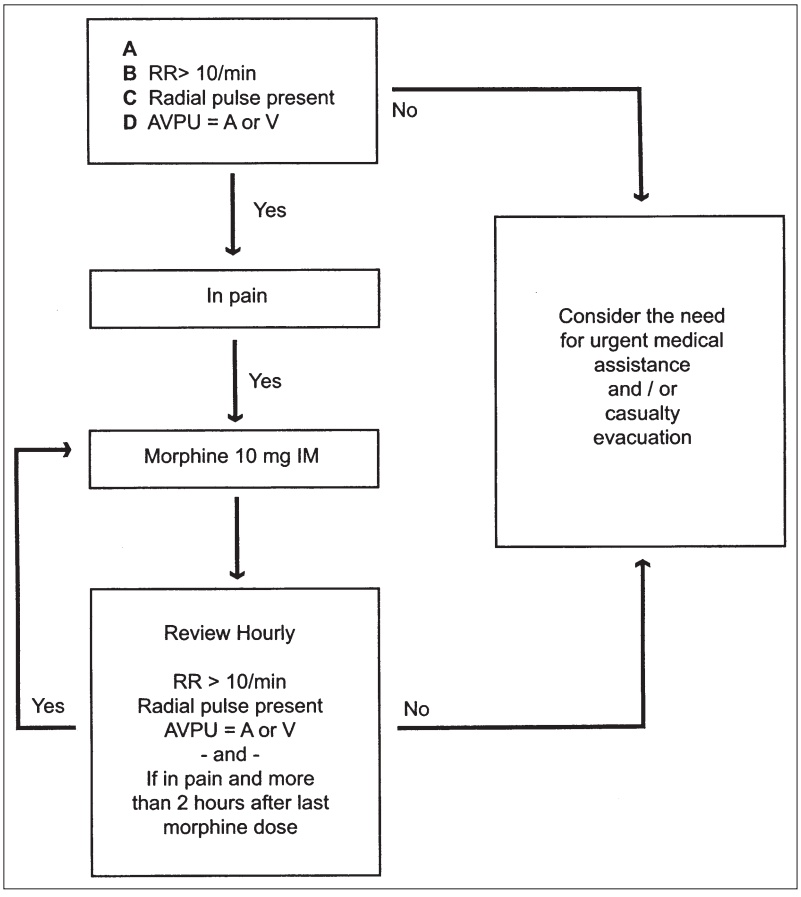
1428. If the above are insufficient or not available, use morphine. Morphine is a powerful analgesic. Morphine is the standard battlefield analgesic used by the British Army. It is supplied to soldiers as a Medimech Auto Injector containing 10 mg of morphine sulphate. This allows self administration or buddy administration of the morphine by intramuscular injection. The limitations of intramuscular drug administration have been outlined in paragraphy 1417 and 1418 but on the battlefield this may be the only practical option.
1429. Side effects of morphine include:
- Drowsiness.
- Nausea and vomiting
- Respiratory depression.

1430. Table 14-1 gives practical guidelines to using morphine as a battlefield analgesic.
1431. A good clinical predictor of effective morphine requirement is age. The average 24 hour morphine requirement for casualties over 20 years of age is 100 mg minus the age in years. The approximate needs of a 20 year old soldier would be 100 mg minus 20 = 80 mg of morphine in 24 hours.
1432. In field hospitals with surgical teams and when other specialist teams, for example IRTs are present, morphine will be available for intravenous administration to casualties. In the resuscitated adult give an initial slow intravenous injection of 5 mg of morphine followed by boluses of 1 to 2 mg according to pain control achieved, heart rate and blood pressure.

Cardio-respiratory deterioration after analgesia requires careful reassessment of the casualty to ensure that an unrecognised or inadequately resuscitated injury is not the cause.

1433. Antiemetics will frequently be necessary when morphine has been used, particularly when the casualty is being transported, as the incidence of vomiting during casualty evacuation is significant. The phenothiazines and metoclopramide are effective in treating nausea and vomiting caused by drugs but ineffective in motion sickness. Motion sickness is treated with drugs such as hyoscine or the antihistamines (for example, cyclizine).
1434. In field hospitals, pain control may be achieved by a combination of NSAIDs or paracetamol, morphine and local anaesthetic blocks.

Table 14-1. Basic approach to battlefield analgesia.



Opioid reversal
1435. Naloxone antagonises the effects of morphine. Available as a 100 micrograms/ml concentration intravenous injection, initial doses are 100-200 micrograms, with increments of 100 micrograms every two minutes. Its action is specific but short lived and the reappearance of respiratory depression after 1 hour is a possibility. The duration of action of naloxone can be prolonged by giving additional doses intramuscularly. Side effects include nausea, tachycardia and hypotension. Analgesia will also usually be reversed.

SEVERE INJURY

Rescue of a trapped casualty and emergency surgical procedures
1436. Ketamine is a powerful analgesic and anaesthetic drug that can be used in the above circumstances. It can be given both intravenously and intramuscularly.

Ketamine should only be used by personnel with appropriate training. As with any drug capable of producing sedation and general anaesthesia, administration should be confined to personnel capable of and equipped for, advanced airway management.

1437. Airway reflexes are better maintained with ketamine than with other sedative drugs *but airway competence and protection is not guaranteed*:

- Salivation increases after ketamine and suction may be required.
- Respiratory depression does not usually happen but may if morphine or other sedative drugs have been given.
- Blood pressure is usually maintained although worsening hypotension may occur in shocked casualties.

1438. Ketamine can cause increases in intracranial pressure (ICP) in spontaneously breathing casualties with intracranial pathology but, in ventilated casualties where blood carbon dioxide levels can be controlled, this is less of a problem.
1439. Ketamine given intravenously (1-2 mg/kg of body weight over 60 seconds) normally produces some 10 minutes of anaesthesia. An intramuscular dose of 10 mg/kg of body weight should, after five to ten minutes, produce 12 - 25 minutes of surgical anaesthesia.
1440. Recovery from Ketamine anaesthesia is associated with hallucinations. These can

be prevented or decreased with small doses of short acting intravenous benzodiazepines. *Use of benzodiazepines increases the risk of airway compromise.*

OTHER METHODS

Inhalation analgesia: Entonox

1441. Entonox is available in military hospitals and on some military ambulances. The mixture is provided from on demand, valved cylinders and administered via a mask mouth piece. Its use as a patient controlled, demand system, means that the casualty is unlikely to overdose himself. If they become drowsy they allow the mask or mouth piece to drop, stop inhaling the mixture, exhale the gas they have received and their level of unconsciousness recovers. Size D cylinders allow 20 - 30 minutes continuous use, the efficiency of which is improved by locating the demand valve at the patient's mouth piece.

> Analgesia will peak some two to five minutes after starting inhalation and this fact needs to be respected when entonox is used to assist procedures such as casualty extraction.

1442. During storage, care must be taken to ensure that the temperature of the gas is not allowed to fall below minus 7°C. At this point, separation of the gases can permit delivery of a hypoxic mixture. Manufacturers recommendations are that such a cylinder should be rewarmed at 10°C for two hours then completely inverted three times (to mix the gases) or rapidly rewarmed by immersion in water at 37°C for five minutes then inverted three times. A practical solution to prevent this is to use a cylinder kept warm in a vehicle cabin (with the engine kept running periodically so as not to allow the cabin to cool overnight in a cold environment).

1443. **Contraindications**. Entonox should not be used:

- In decompression illness.
- In the presence of a pneumothorax unless there is a functioning chest drain in situ.

1444. The reason is that nitrous oxide is able to diffuse out of the blood stream into gas filled cavities (and bubbles) faster than nitrogen can be removed, causing increases in pressure and volume within these cavities and bubbles. Use in head injuries is discussed in paragraph 1454.

Local anaesthesia.

1445. Local anaesthetic blocks can provide safe and effective analgesia in acute trauma. There are a number of limitations in field conditions:

- Personnel with the appropriate anatomical knowledge and training may be not be available.
- Preparation of both casualty and materials is usually less than ideal in respect of access, positioning, fluid resuscitation and sterility.
- There may be insufficient time to perform and wait for the technique to work.
- Inadvertent toxic problems will be difficult to manage on scene.

Safety

1446. Safety is maximised by ensuring that an intravenous cannula has been sited in the casualty (to allow fluid resuscitation and treatment of allergic and toxic reactions to the local anaesthetics), that accidental intravascular injection of local anaesthetic does not occur and the recommended maximum safe doses (MSD) relevant to nerve block and infiltration techniques, are not exceeded).

1447. Lignocaine is a rapid acting local anaesthetic available in 0.5 1, or 2% concentrations with or without adrenaline. The MSD is 4 mg/kg of body weight without adrenaline and 6mg/kg of body weight with. 1% solutions are suitable for most infiltration and nerve block techniques. Use of solutions containing adrenaline are best avoided in the field, complications from systemic absorption of the adrenaline or incorrect injection to areas of vascular compromise, are then avoided.

1448. **Specific blocks**

- *Femoral nerve block*. Inject 10 to 15 ml of 1% lignocaine just below the inguinal ligament at a site 1.5 cm deep and 1.5 cm lateral to the femoral artery. Aspirate the syringe to check the artery has not been punctured. The block will onset in 5 to 15 minutes and last about an hour. It provides good analgesia for femoral shaft fractures allowing them to be reduced and splinted.
- *Haematoma block for reduction of closed wrist fractures*. This is useful when dealing with a large number of casualties. Attention to sterile technique is important to avoid introducing infection in the haematoma. *Adrenaline containing solutions should be avoided.* Inject 15 ml of 1% lignocaine into the fracture haematoma. The block will onset in about 5 minutes and last about one hour.
- *Intercostal nerve blocks* are used in hospitals to treat the pain from fractured ribs. They are also useful when placing chest drains in alert casualties. The practical danger when performing intercostal blocks is the risk of pneumothorax and short, small gauge needles must be employed.

Palpate the rib to be blocked in the posterior axillary line. **If the rib cannot be palpated – do not attempt the block.** Insert the needle through the skin until it hits bone close to the lower margin of the rib. When the needle contacts bone, slowly move it downwards until it just slips under the lower margin of the rib. Aspirate the syringe and check that there is no air or blood obtained. Inject 5 ml or 1% lignocaine. Good analgesia will usually require additional blocks at 1 or 2 levels above and below the fractures.

CLINICAL PROBLEMS

1449. *Analgesia for head injured battle casualties*. The initial management of head injuries should be carried out as described in Chapter 8, treating problems with **A**irway, **B**reathing and **C**irculation. Untreated pain may cause a rise in intracranial pressure which in turn, can worsen a developing brain injury. Excess use of morphine will cause respiratory depression (with hypoxia and hypercapnia) and pupillary assessment during neurological examination may become more difficult.

1450. Pain management in the head injured military casualty is a balance between treating the pain but not masking signs and symptoms of an injury needing neurosurgical attention. In other words: judicious use of analgesics, especially morphine.

1451. The casualty in coma (see paragraphs 0828-0831) after resuscitation is assumed not to be feeling pain.

1452. *Headache* in the casualty with minor and moderate head injury is treated with either paracetamol, NSAIDs or codeine phosphate. Severe headache associated with vomiting or neurological symptoms and signs may indicate an intracranial haematoma. The management of the casualty with an intracranial haematoma is described in Chapter 8.

1453. *Pain due to other injuries*. This is treated with a combination of nerve blocks, paracetamol and NSAIDs. Morphine is used as outlined in Table 14.1. Ideally, morphine if needed, is given as incremental intravanous doses but, if this is not possible, use IM as shown in the table. Level of consciousness and cardiorespiratory state need careful monitoring after using morphine.

1454. *Entonox and head injury*. In a casualty with a fractured skull, the nitrous oxide in entonox could increase the size of intracranial air collections. Practically, casualties with significant head injury are unlikely to be able to self administer entonox. In the casualty with mild concussion and pain from other injuries, entonox should be safe, particularly as the entonox is likely to be given over a short period of time.

Analgesia for battle casualties with chest injury

1455. Fractured ribs and other chest injuries are very painful. The act of breathing moves the broken ribs and makes the pain worse. The casualty is reluctant to take effective breathes resulting in retained secretions in the underlying lung, atelectasis, decreasing oxygenation and decreased carbon dioxide removal. Infection and respiratory failure may follow.

1456. The initial management of chest injuries should be carried out as described in Chapter 6, treating problems with **A**irway, **B**reathing and **C**irculation. These casualties need supplemental oxygen.

1457. After resuscitation, the pain of chest injury is treated with a combination of intercostal blocks, paracetamol or NSAIDs and incremental intravenous opiates. The hospital management will include physiotheraphy and may also involve specialised analgesic techniques such as epidural or intrapleural blocks.

1458. The casualty presenting in respiratory failure needs initial ventilatory support as described in Chapter 4 and will need subsequent management in an intensive care unit.

1459. Entonox and chest injury. In a casualty with a pneumothorax the nitrous oxide in entonox could increase the size of the air collection and may even cause it to tension. A chest drain needs to be placed before entonox is used.

Mass casualties

1460. The provision of effective analgesia for mass casualties needs to be simple in its scope and application, supporting the principle of providing the greatest good for the greatest number. Following triage and resuscitation, intramuscular administration of analgesics is likely to be the most practical solution, particularly if personnel lack cannulation skills, resources are limited or casualties present in large numbers with minor injuries. The monitoring of such casualties may need to rely on minimally trained personnel using simple clinical parameters.

United Kingdom prescribing restrictions

1461. The Medicines Act (1968) and its secondary legislation provides a regulatory scheme of licences, registrations and exemptions which control all aspects of the production and distribution of all medicinal products.

1462. It classifies drugs as:

- General Sales List (GSL) medicines, suitable for unsupervised sale in shops or supermarkets.
- Pharmacy (P) only medicines, which can only be sold or supplied in a pharmacy under the direct supervision of a pharmacist.

- Prescription Only Medicines (POM), which can only be sold or supplied in accordance with a prescription issued by a fully registered medical practitioner.

1463. The Misuse of Drugs Act (1971) provides the basis of control for certain drugs. Drugs are placed into Class A, B or C based on the harmfulness attributable to a drug when it is misused. The penalties for unlawful possession of the more harmful drugs are more severe than for those considered less harmful.

1464. The Misuse of Drugs Act (1985) divides drugs into five schedules which define the classes of person authorised to supply and possess controlled drugs while acting in their professional capacities. Also covered are regulations for prescribing and record keeping.

1465. The Safe Custody Regulations (1973) define the type of cabinet or safe that should be used to store controlled drugs securely. These regulations refer to Schedule 2 and 3 drugs although many Schedule 3 drugs are exempted.

1466. Medical officers, nurses and medical personnel involved in aeromedical transport must be aware of potential legal difficulties imposed by crossing international borders. Most countries prohibit the import and export of medicines (including non-controlled drugs). For non-domestic flights, prior approval and certification from the Department of Health and the Home Office is advised.

SUMMARY

- Resuscitation using the BATLS method comes first.
- Effective analgesia is an essential part of casualty management.
- Methods used depend on your training, the number of casualties, the resources available and the injuries to be managed.
- Start simple, for example, splint limbs and cool burns.
- Effective analgesia may need a combination of techniques and drugs.
- If unsure, get help.